EE 371 First Semester Test - Tuesday October 8, 2002
45 Points, 16.667% of Final Grade

Please put your name on the outside of the paper also. Name ____KEY_____
Hand in the test folded so your name shows on the outside.

1. Assume the following program is downloaded to the HC12 EVB and run. (20 points)

```
0000                1  P EQU     $4000
0000                2  R EQU     $6000
0000                3  S EQU     $8000
4000                4    ORG     P
4000 CF8000         5    lds     #S
4003 CD4017         6    ldy     #CONST
4006 FE4017         7    ldx     const
4009 A640           8    ldaa    0,y
400B 36             9    psha
400C A600          10    ldaa    0,x
400E 33            11    pulb
400F A6ED          12    ldaa    b,y
4011 A644          13    ldaa    !4,y
4013 7C6000        14    std     BUF1
4016 3F            15    swi
4017 4000010D      16  CONST     DB      $40,00,01,$0d,$0a
     0A
6000               17    ORG     R
6000               18  BUF1:     DS      2
6002               19  BUF2:     DS      4
```

a. Where is the program located? ..... $4000_____
b. Where is constant data located? ..... $4017_____
c. Where is variable data located? ..... $6000_____
d. With what value is the stack pointer register initialized in line 5? ..... $8000_____
e. With what value is the Y register loaded in line 6? ..... $4017_____
f. What addressing mode is used in line 6? ..... Immediate_____
g. With what value is the X register loaded in line 7? ..... $4000_____
h. What addressing mode is used in line 7? ..... Extended or Direct_____
i. What value is in the A register after the code in line 8 is executed? ..... $40_____
j. What addressing mode is used in line 8? ..... Indexed_____
k. What is the effective address for the instruction in line 8? ..... $4017_____
l. What value is in the A register after the code in line 9 is executed? ..... $40_____
m. What value is in the stack pointer register after the code in line 9 is executed? $7FFF_____
n. What value is in the A register after the code in line 10 is executed? ..... $CF_____
o. What is the effective address for the instruction in line 10? ..... $4000_____
p. What value is in the B register after the code in line 11 is executed? ..... $40_____
q. What is the offset value for the indexed addressing instruction in line 12? ..... $40_____
r. What is the offset value for the indexed addressing instruction in line 13? ..... $4_____
s. What addressing mode is used in line 14? ..... Extended or Direct_____
t. What is stored in BUF1:BUF1+1 after the program is run? ..... $0A $40_____

2. a. What is an assembler expression ? (2 points)
A combination of symbols, constants, and algebraic operators. The assembler evaluates the expression to produce a value for the operand.

b. Give an example of an assembler expression. (2 points)
ldaa {BUF2-BUF1},x

3. Suppose the indexed addressing instruction
ldaa {BUF2-BUF1},x
is included in the program above. (2 points)
What is the offset the assembler calculates? ..... 2_____

4. Suppose in the program above you wanted to set a breakpoint to see what was loaded in the A register by the code at line 8. (6 points)
a. What D-Bug12 command would you use? ..... BR 400B_____
b. D-Bug12 command would you use to examine the variable data? ..... MD 6000_____
c. What D-Bug12 command would you use to examine the registers? ..... RD_____

5. The A register contains $56 and the memory location DATA contains $FF. State Yes or No if the following conditional branch instructions are taken after the instruction CMPA DATA: (5 points)
a. BGE ..... YES_____
b. BHS ..... NO_____
c. BLE ..... NO_____
d. BLS ..... YES_____
e. BGT ..... YES_____
f. BHI ..... NO_____
g. BLT ..... NO_____
h. BLO ..... YES_____
i. BEQ ..... NO_____
j. BNE ..... YES_____

6. The memory map for an HC12 microcontroller shows:

RAM: $0800 to $0BFF
ROM: $8000 to $FFFF

Give appropriate equates to define the labels for the following: (8 points)

a. ORG PROG ; locate the program code PROG EQU $8000

b. LDS #STACK ; initialize stack pointer STACK EQU $0C00

c. ORG DATA ; locate variables DATA EQU $0800

d. Where should program constant data be located? In ROM after the program